

CLAIMS

1. A remote controller for a respiratory ventilator providing breathing gases to a patient, said controller allowing an operator to move about the ventilator and patient while controlling the ventilator, said controller comprising;

a control member actuatable by an operator to provide a signal for carrying out a control action in the ventilator; and

communication means placing the control member in communication with the ventilator in a manner that allows the control means for the operator to move with respect to the ventilator and patient and to be at a distance from the ventilator, said communication means communicating said signal to the ventilator to control the ventilator.

2. A remote controller of claim 1 for controlling the flow of breathing gases to a patient and wherein said control member is further defined as providing a breathing gas flow control signal.

3. A remote controller of claim 1 for controlling breathing gas pressures and wherein said control member is further defined as providing a breathing gas pressure control signal.

4. A remote controller of claim 1 wherein said control member is actuatable to establish the presence or absence of a signal for carrying out a control action in the ventilator.

5. A remote controller of claim 4 for controlling the flow of breathing gases to a patient and wherein said control member is actuatable to provide a given volume of breathing gases to a patient upon actuation.

6. A remote controller of claim 1 wherein said control member is actuatable to provide a variable magnitude signal for carrying out a control action in the ventilator.

7. A remote controller of claim 6 for controlling the flow of breathing gases to a patient wherein said controller is further defined as including means for controlling the magnitude of the breathing gas flow to the patient in accordance with the magnitude of the control member signal.

8. A remote controller of claim 7 for controlling the flow of breathing gases to a patient wherein said controller is further defined as including means to carry out a control action of providing a breathing gas flow magnitude to the patient that is proportional to the rate of change of the variable magnitude control member signal.

9. A remote controller of claim 1 including means for adjusting the sensitivity between the signal provided by said control member and the resulting control action in the ventilator.

10. A remote controller of claim 1 including means in said ventilator and in communication with said communication means for adjusting the sensitivity between the signal provided by said control member and the resulting control action in the ventilator.

11. A remote controller of claim 9 wherein said control member provides a signal having a magnitude range and wherein said adjusting means alters the sensitivity over the magnitude range of the signal.

12. A remote controller of claim 10 wherein said control member provides a signal having a magnitude range and wherein said adjusting means alters the sensitivity over the magnitude range of the signal.

13. A remote controller of claim 1 including means for establishing desired properties of linearity-non linearity between the signal provided by said control member and the resulting control action in the ventilator.

14. A remote controller of claim 1 including means in said ventilator and in communication with said communications means for establishing desired properties of linearity-non linearity between the signal provided by said control member and the resulting control action in the ventilator.

15. A remote controller of claim 13 wherein said control member provides a signal having a magnitude range and wherein said linearity-non linearity establishing means alters the linearity-non linearity properties over the magnitude range of the signals.

16. A remote controller of claim 14 wherein said control member provides a signal having a magnitude range and wherein said linearity-non linearity establishing means alters the linearity-non linearity properties over the magnitude range of the signal.

17. A remote controller of claim 1 wherein said control member includes a displaceable, signal generating element for providing the signal.

18. A remote controller of claim 17 wherein said element is a switch.

19. A remote controller of claim 17 wherein said element comprises variable resistance means.

20. A remote controller of claim 17 wherein said control member is suitable for being placed in the hand of an operator and has a trigger member connected to a signal generating element for providing the signal.

21. A remote controller of claim 17 wherein said control means is foot operated.

22. A remote controller of claim 1 wherein said control means is eye

operated.

23. A remote controller of claim 1 wherein said control member includes means for providing a signal in accordance with an applied force.

24. A remote controller of claim 1 wherein said controller member provides an electric signal.

25. A remote controller of claim 1 wherein said control member provides a fluidic signal.

26. A remote control of claim 1 wherein said control member provides an analog signal.

27. A remote controller of claim 1 wherein said control member provides a digital signal.

28. A remote controller of claim 1 wherein said communication means comprises a cable connected to said control member and connectable to the respiratory ventilator.

29. A remote controller of claim 28 wherein said control means provides an electrical signal and wherein said cable contains electrical conductors.

30. A remote controller of claim 28 wherein said communication means comprises optical means and said cable contains optical fiber means.

31. A remote controller of claim 1 wherein said communication means comprises a telemetry link.

32. A remote controller of claim 31 wherein said telemetry link

employs invisible light.

33. A remote controller of claim 32 wherein said telemetry link employs infrared radiation.

34. A remote controller of claim 31 wherein said telemetry link is a radio telemetry link.

35. A remote controller of claim 1 wherein said control member further includes a display for providing information to the operator.

36. A system suitable for use with medical apparatus, the system employing a signal indicative of a parameter relating to the apparatus or to a patient associated with the apparatus, the system providing a tactile feedback of the parameter to a user remote from the apparatus, said system comprising:

5 feedback means suitable for being placed in contact with a selected body portion of the user for generating a tactile sensation that can be experienced by the user; and

10 communication means placing the feedback means in communication with the medical apparatus in a manner that allows the user, when in contact with said feedback means, to be distant from the medical apparatus and to move about the apparatus and patient to a desired location, said communication means communicating the signal indicative of the parameter to said feedback means,

said feedback means employing said parameter signal to generate a tactile sensation to the body of the user corresponding to the parameter.

37. A system of claim 36 wherein said feedback means includes actuator means for generating a force on the selected body portion of the user.

38. A system of claim 37 wherein said actuator means comprises an electrical actuator means.

39. A system of claim 37 wherein said actuator means comprises a fluid operated actuator means.

40. A system of claim 37 wherein said actuator means comprises a linear actuator means.

41. A system of claim 37 wherein said actuator means comprises rotary actuator means.

42. A system of claim 39 wherein said fluid actuated means comprises a bladder.

43. A system of claim 36 further including means for adjusting the sensitivity between the parameter signal from the apparatus and the resulting tactile sensation generation.

44. A system of claim 36 including means in said medical apparatus and in communication with said communication means for adjusting the sensitivity between the parameter signal from the apparatus and the resulting tactile sensation generation.

45. A system of claim 43 wherein the apparatus provides a parameter signal having a magnitude range and wherein said adjusting means alters the sensitivity over the magnitude range of the signal.

46. A system of claim 44 wherein the apparatus provides a parameter signal having a magnitude range and wherein said adjusting means alters the sensitivity over the magnitude range of the signal.

47. A system of claim 36 including means for establishing desired

properties of linearity-non linearity between the parameter signal from the apparatus and the resulting tactile sensation generation.

48. A system of claim 36 including means in said apparatus and in communication with said communication means for establishing desired properties of linearity-non linearity between the parameter signal from the apparatus and the resulting tactile sensation generation.

49. A system of claim 47 wherein the parameter signal has a magnitude range and wherein said linearity-non linearity establishing means alters the linearity-non linearity properties over the magnitude range of the signal.

50. A system of claim 48 wherein the parameter signal has a magnitude range and wherein said linearity-non linearity establishing means alters the linearity-non linearity properties over the magnitude range of the signal.

51. A system of claim 36 wherein said feedback means is further defined as suitable for being placed in contact with the hand of the user.

52. A system of claim 51 wherein said feedback means includes a trigger for being placed in contact with the fingers of the user, said feedback means including an actuator for said trigger operable by said parameter signal.

53. A system of claim 36 wherein said apparatus provides a plurality of signals indicative of parameters and wherein said system includes switch means for selecting the parameter to be monitored.

54. A system of claim 36 wherein said communication means communicates a plurality of signals indicative of parameters to said feedback means and wherein said feedback generates tactile sensations to the body of the user incorporating a plurality of parameter signals.

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55. A system of claim 36 further including second feedback means suitable for being placed in contact with a selected body portion of a further user for generating a tactile sensation that can be experienced by the further user; said second feedback means being in communication with one of said feedback means or the medical apparatus to provide a tactile sensation to the further user corresponding to the tactile sensation generated by said feedback means.

56. A system of claim 36 further defined as a remote tactile feedback system for medical apparatus comprising a ventilator, the ventilator providing a signal relating to the ventilation of a patient, and wherein said feedback means generates a tactile sensation to the user indicative of a respiration characteristic.

57. A system of claim 56 wherein said feedback means generates a tactile sensation of the patient airway pressure.

58. A system of claim 56 wherein the feedback means generates a tactile sensation of the tidal volume of breathing gases delivered to the patient.

59. A system of claim 52 further defined as a remote tactile feedback system for medical apparatus comprising a ventilator, the ventilator providing a signal relating to the ventilation of a patient and wherein said feedback means generates a tactile sensation to a user indicative of a respiration characteristic.

60. A system according to claim 59 wherein said feedback means generates a tactile sensation of the patient airway pressure.

61. A system of claim 59 wherein said feedback means generates a tactile indication of the tidal volume of breathing gases delivered to the patient.

62. A system of claim 36 including display means for displaying

information for a user.

63. A system of claim 51 wherein said feedback means has a base for positioning the feedback means on a surface.

64. A system of claim 36 wherein said system provides a tactile feedback of a parameter comprising at least one of patient airway pressure, patient breathing gas flow, patient tidal volume, patient pulse rate, patient blood pressure, and patient arterial blood oxygen saturation.

65. A remote control and tactile feedback system for medical apparatus, the system allowing an operator to move about the medical apparatus or patient while controlling the apparatus and receiving a tactile feedback of a parameter, the system employing a signal indicative of a parameter relating to the apparatus or to a patient associated with the apparatus, said system comprising:

control means actuatable by an operator to provide a control signal for carrying out a control action in the medical apparatus;

feedback means suitable for being placed in contact with a selected body portion of the user for generating a tactile sensation that can be experienced by the user; and

communication means placing the control means and feedback means in communication with the medical apparatus in a manner that allows the operator to move about the apparatus and patient and to be at a distance from the apparatus, said communication means communicating the control signal to the medical apparatus to control the apparatus, said communication means communicating the signal indicative of the parameter to said feedback means,

said feedback means employing said parameter signal to generate a tactile sensation to the body of the user corresponding to the parameter.

66. A system of claim 65 wherein said feedback means includes actuator means for generating a force on the selected body portion of the user.

67. A system of claim 66 wherein said actuator means comprises an electrical actuator means.

68. A system of claim 66 wherein said actuator means comprises a fluid operated actuator means.

69. A system of claim 66 wherein said actuator means comprises a linear actuator means.

70. A system of claim 66 wherein said actuator means comprises rotary actuator means.

71. A system of claim 65 wherein said control member is actuatable to establish the presence or absence of a signal for carrying out a control action in the ventilator.

72. A system of claim 65 wherein said control member is actuatable to provide a variable magnitude signal for carrying out a control action in the ventilator.

73. A system of claim 72 for controlling the flow of breathing gases to a patient wherein said controller is further defined as including means for controlling the magnitude of the breathing gas flow to the patient in accordance with the magnitude of the control member signal.

74. A system of claim 73 for controlling the flow of breathing gases to a patient wherein said controller is further defined as including means to carry out a control action of providing a breathing gas flow magnitude to the patient that is

proportional to the rate of change of the variable magnitude control member signal.

75. A system of claim 65 wherein said control member includes a displaceable, signal generating element for providing the signal.

76. A system of claim 75 wherein said element is a switch.

77. A system of claim 75 wherein said element comprises variable resistance means.

78. A system of claim 65 wherein said control means and feedback means comprise a common element.

79. A system of claim 78 wherein said common element is further defined as suitable for being placed in contact with the hand of the user.

80. A system of claim 79 wherein said common element includes a trigger for being placed in contact with the fingers of the user, said feedback means including an actuator for said trigger operable by said parameter signal.

81. A system of claim 65 further including a display for providing information to the operator.

82. A system of claim 65 including means for adjusting the sensitivity between the control or parameter signal and the respective resulting control action in the ventilator or tactile sensation generation.

83. A system of claim 65 including means in said ventilator and in communication with said communication means for adjusting the sensitivity between the control or parameter signal and the respective resulting control action in the ventilator or tactile signal generation.

84. A system of claim 82 wherein at least one of said signals has a magnitude range and wherein said adjusting means alters the sensitivity over the magnitude range of the signal.

85. A system of claim 83 wherein at least one of said signals has a magnitude range and wherein said adjusting means alters the sensitivity over the magnitude range of the signal.

86. A system of claim 65 including means for establishing desired properties of linearity-non linearity between the control or parameter and the respective resulting control action in the ventilator or tactile sensation generation.

87. A system of claim 65 including means in said ventilator and in communication with said communications means for establishing desired properties of linearity-non linearity between the control or parameter signal and the respective resulting control action in the ventilator or tactile sensation generation.

88. A system of claim 86 wherein at least one of said signals has a magnitude range and wherein said linearity-non linearity establishing means alters the linearity-non linearity properties over the magnitude range of the signals.

89. A system of claim 87 wherein at least one of said a signals has a magnitude range and wherein said linearity-non linearity establishing means alters the linearity-non linearity properties over the magnitude range of the signal.

90. A system of claim 65 wherein one of said control member or feedback member employs an electric signal.

91. A system of claim 65 wherein one of said control member or feedback member employs a fluidic signal.

92. A system of claim 65 wherein one of said control member or feedback member employs an analog signal.

93. A system of claim 65 wherein one of said control member or feedback member employs a digital signal.

94. A system of claim 65 wherein said communication means comprises a cable.

95. A system of claim 94 wherein said communication means comprises electrical means and wherein said cable contains electrical conductors.

96. A system of claim 94 wherein said communication means comprises optical means and said cable contains optical fiber means.

97. A system of claim 65 wherein said communication means comprises a telemetry link.

98. A system of claim 97 wherein said telemetry link employs invisible light.

99. A system of claim 97 wherein said telemetry link employs infrared radiation.

100. A system of claim 97 wherein said telemetry link is a radio telemetry link.

101. A system of claim 65 for controlling the flow of breathing gases to a patient and wherein said control means is further defined as providing a breathing gas flow control signal.

102. A system of claim 65 for controlling breathing gas pressures and wherein said control means is further defined as providing a breathing gas pressure control signal.

103. A system of claim 65 wherein said system generates a tactile sensation of a parameter comprising one of patient airway pressure, patient breathing gas flow, patient tidal volume, patient pulse rate, patient blood pressure, and patient arterial blood oxygen saturation.

104. A system of claim 103 wherein said feedback means generates a tactile sensation of the patient airway pressure.

105. A system of claim 103 wherein the feedback means generates a tactile sensation of the tidal volume of breathing gases delivered to the patient.

106. A system of claim 65 wherein said communication means communicates a plurality of signals indicative of parameters to said feedback means and wherein said feedback generates tactile sensations to the body of the user incorporating a plurality of parameter signals.

107. A remote control and tactile feedback system for a respiratory ventilator, the system allowing an operator to move about the ventilator or patient while controlling the ventilator and receiving a tactile feedback of a parameter, the system employing a signal indicative of a parameter relating to the ventilator or to a patient associated with the apparatus, said system comprising:

a member suitable for being placed in the hand of the operator and having a trigger connected to a signal generator to provide a control signal for carrying out a control action in the ventilator, said member having actuator means for operating said trigger to generate a tactile sensation that can be experienced by the user; and

10 communication means placing the signal generator and actuator in
communication with the ventilator in a manner that allows the operator to move about
the apparatus and patient and to be at a distance from the apparatus, said communication
means communicating the control signal to the ventilator to control the apparatus, said
communication means communicating the signal indicative of the parameter to said
15 actuator to generate a tactile sensation to the body of the user corresponding to the
parameter.